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Application of Plasmonic Catalysts for Efficient H_2 Production from Hydrogen Carrier Molecules

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Plasmonic nanostructures are capable of utilization of abundant solar energy by localized surface plasmon resonance (LSPR). LSPR can be described as the collective oscillation of valence electrons for establishing a resonance between the photons and surface electrons of nanoparticles (NPs), driven by the electromagnetic field of incident light. Such LSPR has promising applications in the energy conversion and storage. Hydrogen is regarded as a promising fuel. Ammonia borane (NH_3BH_3) and formic acid (HCOOH) containing high hydrogen content are attractive candidates as chemical hydrogen carrier molecules. In the exploitation of highly efficient nanocatalysts, special attention has been drawn to the plasmonic nanostructures, including conventional noble metals and non-conventional semiconductor nanocrystals [1-6]. In this study, we demonstrated that the plasmonic nanostructures, bimetallic Pd/Ag NPs on SBA-15 mesoporous silica, Pd/MoO_{3-x} nanosheet hybrid, core-shell Au@Pd NPs supported on Ti doped Zr based amine-functionalized MOFs (UiO-66($Zr_{100-x}Ti_x$)), can be used as highly efficient catalysts under visible light for H_2 production from NH_3BH_3 and HCOOH. The moderate control of electron density of Pd metal and surface acid-basic properties of support are key factors to realize efficient H_2 production.

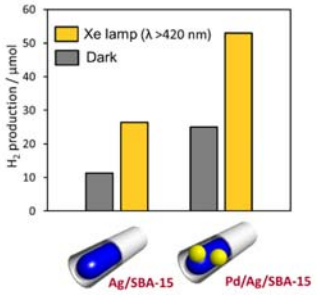

Figure 1. H_2 production from NH_3BH_3 on plasmonic Ag/SBA-15 and Pd/Ag/SBA-15 catalysts.

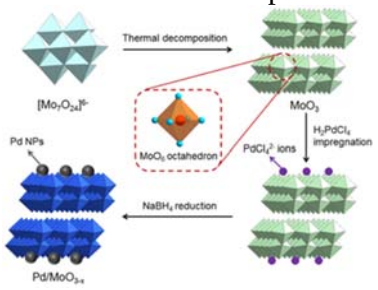

Figure 2. Preparation of plasmonic Pd/MoO_{3-x} hybrid catalyst.

References:

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